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Prevalence of psychoactive drug use among drivers in Thailand: A roadside survey

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ABSTRACT

The objective of this study was to determine the prevalence of psychoactive drug and alcohol use among general drivers and predictors of the drug use in Thailand. One thousand six hundred and thirty-five motor vehicle drivers were randomly selected from five geographical regions of Thailand between December 2005 and May 2006.

The prevalence of psychoactive drugs was determined using urine tests by gas chromatography/mass spectrometry (GC/MS).

Among 1635 drivers, 5.5% were tested positive for breath alcohol with 2% having a level exceeding the legal limit ($\geq$50 mg%). Psychoactive drug was presented in 158 (9.7%) urine samples for drug analysis. The top 3 most frequently detected licit drugs were antihistamines (2.0%), sedative cough suppressant (0.7%) and benzodiazepines (0.2%). Illicit drugs detected included amphetamine (1.8%), cannabis (1.1%), mitragynine (Kratom) (0.9%) and morphine (0.1%). Only type of driver (commercial/non-commercial) was a significant predictor with psychoactive drug use.

The prevalence of psychoactive drug use among drivers not involved in road crashes in Thailand was not as low as an earlier study in Europe using objective measurements, particularly among commercial drivers. However, for illicit drugs, the prevalence detected in this study was lower than those of earlier studies from high-income countries.

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1. Introduction

Worldwide, the mortality from road traffic injury is projected to increase from 1.2 million in 2002 to 2.1 million in 2030, primarily due to increased motor vehicle fatalities associated with economic growth in low- and middle-income countries (Mathers and Loncar, 2006). Despite the fact that a disproportionate amount of this burden is in low- and middle-income countries, available information on the pattern and risks associated with road traffic injuries in these settings is limited.

Several drugs are known to impair an individual's ability to drive and subsequently increase the risk of road traffic injury. Alcohol is the most well studied of these (Brewer et al., 1994; Rio et al., 2001), but a range of other psychoactive substances, including both illicit and licit drugs, also increase the risk of road traffic injuries by affecting alertness, visual acuity, reaction time, judgment and decision making (Benzodiazepine/Driving Collaborative Group, 1993; Barbone et al., 1998; Christensen et al., 1990; Landauer, 1986; Movig et al., 2004). These include amphetamine, cocaine and benzodiazepine.

Earlier studies on the prevalence of psychoactive drug use among drivers have been undertaken in high-income countries (Appenzeller et al., 2005; Athanaselis et al., 1999; Carmen del Rio et al., 2002; Kelly et al., 2004; Seymour and Oliver, 1999; Sugrue et al., 1995). Most of them dealt with high risk drivers i.e., those involved in a road crash or being suspected of using the substances while driving. According to these earlier studies, common psychoactive drugs used among drivers involved in motor vehicle accidents (MVAs) are cannabis (3.5–27%), cocaine (33%), amphetamine (4.6–14%), opioid (19%) and ben-

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zodiazepine (3–12%). So far there has been limited research describing the prevalence of drug use in low- and middle-income countries.

The purpose of the present investigation was to determine the prevalence of psychoactive drug and alcohol use among general drivers and predictors of the drug use.

2. Methods

2.1. Study design

A cross-sectional survey has been performed to determine the prevalence of psychoactive drug and alcohol use among general Thai drivers and to demonstrate predictors of psychoactive drug use. The project was approved by the Ethics Committee for research in human subjects of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

2.2. Sampling design and data collection

The recruitment period of this project was from December 2005 to May 2006. The population of this project was divided into three independent samples of vehicle drivers.

The first sample included all drivers (commercial and non-commercial) using petrol station services during the daytime and night time. For this sampled population, one urban and one rural petrol station were randomly selected from within one province from each of the four main geographical regions of Thailand and within Bangkok. Provinces were Chiang Mai in the northern region, Nakhon Ratchasima in the northeastern region, SongKhla in the southern region, and Chonburi in the central region and Bangkok. The investigative team spent 1 day at each petrol station from 9:00 am to 1:00 pm and 5:00 pm to 7:00 pm. All consecutive drivers who entered the petrol station were asked to participate while they were having their gas tank filled. The second sample included bus drivers from the two biggest bus terminals and truck drivers from the biggest truck terminal in Bangkok. This second sample was aimed to ensure a sufficient number of samples of commercial drivers that were rarely available at the petrol stations. All consecutive drivers who entered the terminals were asked to participate.

The third sample of drivers was recruited at 4 sobriety checkpoints set up on the roadside by police during 10 pm–1 am each on an arterial road drawing traffic into Bangkok from each of the 4 directions. For each checkpoint, the police requested every 5–7 vehicle approaching the checkpoint to stop at a time and all drivers were asked to participate. The number of vehicles and time interval for vehicle selection were determined by the availability of field staffs to conduct a subject interview and breath test. This sample was aimed to capture the drivers deemed to be more likely to use alcohol and/or illicit drugs during the late night. The target sample size was 100 drivers from each of the 10 petrol stations, from the bus terminals, from the truck terminal and from each of the 4 sobriety checkpoints.

For respondents, trained field staff administered a structured questionnaire, performed an observation checklist and collected a urine sample. The questionnaire covered drug and substance use patterns, demographic data, vehicle characteristics, history of road traffic accident, and known risk factors such as, age, sex, type of vehicle, helmet use and seat belt use. The following characteristics of both respondents and non-respondents were recorded using a direct-observation checklist; sex, age group, helmet use, seatbelt use, and conspicuity of helmet and vehicles. All urine samples were stored immediately in an ice-packed container, maintained at 0–4°C and subsequently transferred to a central laboratory (The National Doping Center, Faculty of Science, Mahidol University).

2.3. Measurement of drugs and alcohol

The primary outcome of the study was use of alcohol, illicit drugs and/or licit drugs known to be affecting driving performance. Respondents were breath tested for alcohol by trained personnel using a calibrated breathalyzer (Lion Alco meter SD-400).

Urine samples with a volume greater than 50 ml were obtained and analyzed for the presence of licit and illicit drugs using gas chromatography/mass spectrometry (GC/MS) techniques at a central laboratory, the National Doping Center, Faculty of Science, Mahidol University.

To simplify the statistical analysis based on drug-effects on cognitive functions, drugs were categorized into 3 groups. The first was licit drugs including antihistamines, sedative cough suppressants (codeine or dextromethrophan), benzodiazepines, phenothiazine antipsychotics, tricyclic antidepressants, and the anticonvulsants phenytoin and carmabazepine. The second was illicit drugs including opiates, amphetamines and related stimulants (such as methamphetamine, ephedrine, pseudoephedrine, phentermine and cocaine), methadone, cannabinoids, and *Mitragyna speciosa* or Kratom (local addictive plant containing mitragynine). Any non-psychoactive drug was placed into a miscellaneous group. Positive drug use was defined as the finding of a urine drug concentration more than 50 ng/ml from GC/MS.

2.4. Statistical analysis

Data were entered into EpiData version 3.1 (Lauritsen and Bruus, 2003) to prepare for analysis. Double data entry was performed independently. A checking file was developed for quality control. Then two data sets were merged by the identification number for the purpose of checking and clearing before analysis. Descriptive statistics and tabulation were used to obtain the crude prevalence of psychoactive drug use. The mean and SD or median and range were used to describe continuous data. Frequency count and percentage were used for categorical data. Independent *t* tests (or Mann–Whitney test) and χ^2 (or the exact probability test) were used to compare characteristics between respondents and non-respondents; and between users of psychoactive drugs and non-psychoactive drugs for continuous and categorical data, respectively. Unconditional logistic regression analysis using STATA 9.0 (Statacorp, TX) was performed to test the association between potential predictors and outcomes.

3. Results

Out of 2896 drivers recruited, 1642 (56%) of them took part in the study and adequate urine samples could be obtained from 1635 subjects (99.5% of the respondents) In fact, the problem of non-response was only encountered at the petrol stations. According to Table 1, the majority of respondents and non-respondents were male aged between 30 and 60 years old. The findings suggested that our samples from petrol stations were more predominated with non-commercial drivers and motorcyclists as compared to the non-respondents. For motorcyclists, respondents had a higher proportion of helmet use and more had daytime running lights on while driving than non-respondents. Table 2 depicted the distribution of samples by sites of sampling.

3.1. Characteristics of drivers

Taking into account the total samples from all sites, our driver samples were predominantly male in middle to late adulthood as

Table 1
Driver's characteristics among response and non-response groups (only petrol station sample).

Factors	Non-response n (%)	Response n (%)	P-value
Sex			
Male	972 (77.82)	795 (79.50)	0.335
Female	277 (22.18)	205 (20.50)	
Age (year)			
≤30	415 (33.66)	302 (30.69)	0.322
>30–60	783 (63.50)	651 (66.16)	
>60	35 (2.84)	31 (3.15)	
Smell of alcohol			
Yes	26 (2.32)	24 (2.63)	0.647
No	1097 (97.68)	888 (97.37)	
Purpose of driving			
Non-commercial	1056 (91.59)	800 (86.11)	<0.001
Commercial	97 (8.41)	129 (13.89)	
Type of vehicle			
Motorbikes	438 (34.84)	380 (37.89)	0.018
Three or four-wheels	793 (63.09)	587 (58.52)	
More than six-wheels	26 (2.07)	36 (3.59)	
Motorbike's driver			
Wearing a helmet			
Yes	250 (57.08)	257 (67.81)	0.002
No	188 (42.92)	122 (32.19)	
Daytime light			
Yes	287 (74.35)	272 (81.93)	0.015
No	99 (25.65)	60 (18.07)	
Car's driver			
Wearing a seat belt			
Yes	619 (76.51)	486 (78.39)	0.402
No	190 (23.49)	134 (21.61)	

shown in Table 3. Non-commercial drivers constituted the majority who were driving in a car. Most of them had been driving for more than 5 years.

3.2. Prevalence of alcohol use and psychoactive drug use across sites of data collection

Among 1635 drivers, 5.5% had alcohol breath test positive with 2% having a breath alcohol level exceeding the legal limit (≥50 mg%). Also as expected, a positive alcohol breath test was most prevalent among samples from the checkpoints (Table 4). Urine analysis revealed 9.7% of samples positive for psychoactive drugs with a higher percentage (6.3%) for licit drugs as compared to that (2.3%) of illicit drugs. The most frequently detected licit drugs were antihistamines (2.0%, 95%CI 1.3–2.8%), sedative cough suppressant (0.7%; 95% 0.5–1.6%), and benzodiazepines 0.2% (95% 0.1–0.4%). Illicit drugs detected included amphetamine 1.8% (95%CI 1.2–2.6%), cannabis 1.1% (95%CI 0.6–1.7%), mitragynine (Kratom) 0.9% (95%CI 0.5–1.5%) and morphine 0.1% (95%CI 0.01–0.4%).

Table 2
Number of drivers included in the 3 independent samples.

Site	N (%)
Petrol station services	1007 (61.59)
Chiangmai	197 (19.56)
Bangkok	209 (20.75)
Chonburi	191 (18.98)
Nakornratchasrima	210 (20.85)
Songkla	200 (19.86)
Bus and truck terminals	200 (12.23)
Checkpoints	428 (26.18)

Table 3
Characteristics of drivers in survey (all samples).

Characteristics	Petrol station n (%)	Bus and truck terminal n (%)	Checkpoint n (%)
Sex			
Male	805 (79.94)	200 (100.00)	398 (92.99)
Female	202 (20.06)	0	30 (7.01)
Age			
≤30	271 (26.91)	16 (8.08)	131 (30.61)
>30–60	697 (69.22)	18 (90.91)	296 (69.16)
>60	39 (3.87)	2 (1.01)	1 (0.23)
Purpose of driving			
Non-commercial	864 (86.06)	0	332 (77.57)
Commercial	140 (13.94)	200 (100.00)	96 (22.43)
Type of vehicle			
Motorbike	367 (36.48)	0	124 (28.97)
Car	599 (59.54)	0	218 (50.93)
Bus/truck	40 (3.98)	200 (100.00)	86 (20.09)
Experience of driving (years)			
≤4	161 (16.20)	19 (9.50)	69 (16.12)
5–10	372 (37.42)	51 (25.50)	157 (36.68)
11–15	126 (12.68)	37 (18.50)	72 (16.82)
>15	335 (33.70)	93 (46.50)	130 (30.37)

Note: Time of data collection. Petrol station: 9:00 am–1:00 pm and 5:00 pm–7:00 pm; bus and truck: 9:00 am–2:00 pm; checkpoint: 10:00 pm–1:00 am.

3.3. Predictors of urine psychoactive drugs

According to univariate analysis, Table 5 revealed that drivers using psychoactive drugs significantly differed from those not using the drugs in terms of purpose of driving and type of motor vehicle used. In multivariate analysis, only purpose of driving (commercial/non-commercial) was significantly associated with psychoactive drug use. Except for a few driver characteristics, the prevalence of all types of substance use was similar regardless of driver characteristics (Table 6). Nevertheless, the prevalence of illicit drug use was significantly higher among commercial drivers than that among non-commercial drivers.

Table 4
Prevalence of alcohol use and psychoactive drugs use according to sites of data collection.

	Petrol station (n = 1007) N (%)	Bus and truck terminals (n = 200) N (%)	Checkpoint (n = 428) N (%)
Alcohol breath test			
<50	979 (98.79)	198 (99.50)	405 (94.63)
≥50	12 (1.21)	1 (0.50)	23 (5.37)
Joint prevalence of alcohol use and psychoactive drug use			
No substance	915 (90.86)	175 (87.50)	357 (83.41)
Alcohol only	8 (0.79)	1 (0.50)	21 (4.91)
Psychoactive drug only[a]	80 (7.94)	24 (12.00)	48 (11.21)
Alcohol and psychoactive drug[b]	4 (0.40)	0 (0.00)	2 (0.47)
Licit drugs			
Antihistamine	18 (1.79)	0	14 (3.27)
Cough suppressant	8 (0.79)	1 (0.50)	2 (0.47)
Benzodiazepines	4 (0.40)	0	0
Illicit drugs			
Amphetamine	7 (0.70)	9 (4.50)	14 (3.27)
Cannabis	7 (0.70)	6 (3.00)	5 (1.17)
Mitragynine (Kratom)	0	4 (2.00)	11 (2.57)
Morphine	2 (0.20)	0	0

Note: Time of data collection. Petrol station: 9:00 am–1:00 pm and 5:00 pm–7:00 pm; bus and truck: 9:00 am–2:00 pm; checkpoint: 10:00 pm–1:00 am.

[a] Single or multiple drug use.

[b] Alcohol with single or multiple drug use.

Table 5
Factors associated with urine psychoactive drug (all samples).

Characteristics	Non-psychoactive drug N = 1477 (%)	Psychoactive drug N = 158 (%)	*P*-value
Sex			
Male	1263 (85.51)	140 (88.61)	0.289
Female	214 (14.49)	18 (11.39)	
Age[a]			
≤30	378 (25.63)	40 (25.32)	0.845
+30–60	1058 (71.73)	115 (72.78)	
+60	39 (2.64)	3 (1.90)	
Alcohol level[a]			
<50	1433 (97.95)	149 (96.13)	0.148
≥50	30 (2.05)	6 (3.87)	
Purpose of driving[a]			
Non-commercial	1100 (74.63)	96 (60.76)	<0.001
Commercial	374 (25.37)	62 (39.24)	
Sample population			
Petrol station	923 (62.49)	84 (53.16)	0.072
Bus terminal	176 (11.92)	24 (15.19)	
Checkpoint	378 (25.59)	50 (31.65)	

[a] *N* was not equal to 158 and 1477 for psychoactive and non-psychoactive group.

4. Discussion

This first roadside survey study provided evidence on the prevalence of substance use among the driver population in Thailand. This kind of evidence has been scanty from earlier studies undertaken in both high-income countries and middle-to-low income countries (Davis et al., 2003).

Given differences in sampling techniques, the body fluid used in drug detection and laboratory techniques for analyzing the body fluids, the comparison of results across studies was difficult.

In a broad sense, the prevalence of psychoactive drug use (9.7%) among general drivers in this study was lower than that (16.8%) of a similar study in Scotland using a roadside survey. However, this comparison seems to be invalid due to at least two reasons. Firstly, the drug mix reported in the two studies was not the same. Secondly, the accuracy of the techniques used in each study was not the same for each specific drug. For detection of certain illicit drugs (amphetamine, cannabinoids, opiates and cocaine) the accuracy was similar between the two studies (Verstraete, 2005). However, the test performance in detection of benzodiazepines between the two studies was different (Verstraete, 2005).

Keeping in mind the difficulties in comparison of the prevalence of psychoactive drug use as a whole across studies, it might be more valid to compare certain specific drugs between the two studies. With the higher accuracy of the technique for detecting benzodiazepines in this study, the prevalence was reported to be 17.5 times lower than that (3.5%) of the other study (Wylie et al., 2005). Similarly, the prevalence of cannabinoids use found in this study was 3.2 times lower than that (3.5%) of the other study (Wylie et al., 2005).

Table 6
Prevalence of using illicit drug, licit drug, and alcohol by characteristics of drivers.

Factors	Prevalence (95% CI)		
	Illicit drug	Licit drug	Alcohol ≥50 mg/dl
Sex			
Male	7.48 (6.12–9.06)	5.84 (4.65–7.25)	2.59 (1.81–3.59)
Female	4.31 (2.07–7.93)	6.90 (3.94–11.20)	0
Age			
≤30 years	6.70 (4.45–9.68)	5.50 (3.49–8.26)	2.88 (1.49–5.03)
31–60 years	7.16 (5.71–8.87)	6.14 (4.80–7.73)	1.98 (1.25–2.97)
>60 years	7.14 (1.47–20.87)	7.14 (1.47–20.87)	2.70 (0.07–15.06)
Type of vehicle			
Motorbike	6.52 (4.46–9.20)	6.72 (4.63–9.44)	2.69 (1.43–4.60)
Car	5.02 (3.60–6.81)	6.12 (4.54–8.07)	2.10 (1.22–3.36)
Bus/truck	12.88 (9.29–17.41)	4.60 (2.58–7.59)	1.85 (0.68–4.02)
Purpose of driving			
Commercial	12.39 (9.30–16.16)	5.73 (3.71–8.46)	2.08 (0.95–3.95)
Non-commercial	5.10 (3.90–6.55)	6.10 (4.78–7.67)	2.28 (1.51–3.32)

The uniqueness of this study is probably the first to report mitragynine use among drivers with a prevalence (0.9%) in similar to that (1.1%) of cannabis. Mitragynine (also known as Kratom) is one of the alkaloids found in the leaves of the South-East Asian tree *Mitragyna speciosa*, which is used extensively in Thailand to increase work output and tolerance of direct sunlight. Mitragynine has psychoactive properties and has been associated with being used as an opium substitute. Mitragynine is known to be addictive. Withdrawl symptoms include, depression, jerking of the limbs,watering of the eyes and a darkening of the area surrounding the eyes known as hepatic face. Psychotic breaks have been documented in long time users during a published study in Thailand (http://en.wikipedia.org/wiki/Mitragyna_speciosa).

This new finding highlights an important issue of including indigenous substances with potential effects on driving performance in a survey like this and also in a study aiming to test an association between substance abuse and road traffic injury.

A number of countries such as Germany, Sweden, and the USA have either administrative or legal sanctions or both against drug use among commercial drivers (Walsh, 2000). It was found, in this study, that commercial drivers were more likely to use psychoactive drugs than non-commercial drivers. Further studies with a larger number of samples and better controls for confounders are still needed to confirm this finding.

Although policies to curb drink driving in high-income countries were well established with strong support of evidence on both the scope of the problems and effectiveness of interventions, the evidence about the scope of this problem in low- and middle-income countries is scanty, especially among non-accident involved drivers.

This study showed the prevalence of alcohol impaired drivers not involved in road crashes to be 2.0%. This figure was lower than those (4.0–8.0%) reported from some African countries but was higher than those reported from the U.K. (1.0–1.7%) (Davis et al., 2003). However, one should keep in mind that the cut-off value for impaired alcohol level in Thailand is 50 mg/dl whereas that of the U.K. and of many African countries is 80 mg/dl (Davis et al., 2003).

In comparison to an earlier study in Thailand in 1999 (Chongsuvivatwong et al., 1999), the figure in this study was also lower than the lowest estimate of that study. The lower figure found in this study might indicate a sampling variation between the two studies, or an improvement in the trend of alcohol impaired driving in Thailand over the last decade, albeit the increasing trend of alcohol consumption (Ritthiphakdee, 2006). Nevertheless, hospital data documented a rising trend of alcohol impaired drivers, suffering from road traffic injury during those years (Suriyawongpaisal et al., 2007). Hence, it is difficult to draw a conclusion on actual trends of drink driving problems in the country.

A concern of adverse effects of multiple drug use on driver performances has led European directives (Second Council Directive 91/439/EEC, Annex III, Art. 15.1) to ban the issuing or renewing of driving licenses to applicants or drivers who regularly use psychotropic substances, in whatever form International Council on Alcohol, Drugs and Traffic Safety (2001). The prevalence of multiple drug use found in this study (0.5%) is much lower than those (5–17.5%) in a few other studies Transportation Research Circular (2006), which were conducted in accident involved drivers. This extraordinarily low prevalence could hardly be a result of insensitive detection technique based on the GC/MS analysis of urine samples. It could partially be due to selection bias towards a low risk driver population (see Table 1).

With the majority of the samples recruited on a voluntary basis, this study suffered from volunteer bias towards low risk drivers. This could potentially result in under reporting of the prevalence of illicit drug use. However, the likelihood of under reporting of alcohol use was minimal, given similar proportions of alcohol smell detected between respondents and non-respondents.

5. Conclusion

The use of licit drugs and illicit drugs other than alcohol among drivers has been a growing concern among policy makers and investigators in developed countries for over a decade. This concern has led to research and subsequently to policy development and implementation in those countries. Regrettably, in developing countries with the lion's share of global road traffic injury, evidence related to the drug use is rare.

This study is probably among the earliest reports from developing countries to shed lights on the prevalence of licit and illicit drug use among drivers in moving vehicles using a urine test. In broad comparison with other studies, the present study revealed a much lower prevalence of both licit and illicit drug use. Mitragynine use was reported with a prevalence close to that of cannabis use which has been reported to be the most frequent illicit drug use from drivers in developed countries. This raises a concern about including commonly found indigenous drugs in future studies on illicit drug use among drivers. A predictor of illicit drug use was found to be the purpose of driving (commercial or non-commercial).

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